# Investigations of the CO-Chemiluminescence in the Reaction of Ketene With Excess Oxygen Atoms

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The interactions of carbonaceous combustion species from rocket plumes with the atmosphere are thought to play an important role in the production of ultraviolet, visible and infrared radiation signatures at high altitudes. A detailed understanding of the pertinent chemical reactions that produce the electronically excited species, and of the competing quenching reactions that remove the internal energy in radiation-less processes is needed to accurately calculate short wavelength plume spectral signatures, absolute radiances and their temporal/spatial evolution in the high atmosphere. To facilitate these efforts, we have carried out laboratory investigations to elucidate the reaction mechanisms in the oxidation of CH, $CH_2$, $C_2H$, and $C_2O$ with O-atoms and $O_2$.

Sufficient exothermicity in CH, $CH_2$ and $C_2H$ reactions (except $C_2H$ + O) is available to produce CO in one or more of the triplet states (a, a' and d). Even more reaction enthalpy is available in $C_2O$ reaction(s) to produce higher excited states of CO (e, A, I and D). Other excited species such as $CH(A^2\Delta)$ in $C_2H$ plus O or $O_2$, and $OH(A^2\Sigma^+)$ in CH + $O_2$ reactions are also possible. CO-uv chemiluminescence has previously been identified in $C_2H$ + $O_2$ reaction and both CO-uv and CO-vuv in the $C_2O$ + O reaction. However, no information is available on the product branching ratios of the excited CO states responsible for the emission. Estimates of the branching ratio of $CH(A^2\Delta)$ formation in the reactions of $C_2H$ with O and $O_2$ can be found in the literature.

To our knowledge, triplet CO formation in CH and $CH_2$ reactions has not yet been positively identified. Fast discharge-flow tube and pulsed-laser photolysis methods have been employed in this work to study the reaction kinetics and chemiluminescence in the ketene plus O-atom flame. The experimental approach used and the results obtained will be presented.